Chapter 7
CNR Frequency Management

7-1. Overview

The term "battlefield spectrum management" refers to managing electromagnetic spectrum resources to support telecommunications (including weapons systems) and EW requirements. This management includes allocating and assigning generating frequency resources and distributing the variables for FH radio systems. The items for management include frequencies, TSK variables, net identifiers, COMSEC variables, and time. International agreements determine frequency allocations. COMSEC variables are controlled in accordance with TB 380-40. This manual supplements those agreements and regulations for FH radio systems. TSK variables, net identifiers, time, and assignment of frequencies to hopsets are distributed at the discretion of the corps and division communications planners. However, equipment parameters impose some constraints on the distribution schemes for TSKs, net identifiers, and frequency allocations to hopsets (particularly for HF systems).

7-2. Frequency Allocations

a. The table of frequency allocations is an international agreement under the control of the International Telecommunications Union (ITU). The table provides frequency allocation by type of service. Each nation can modify the table or reallocate bands as needed inside their international boundaries. The battlefield spectrum manager (BSM), with the signal planning element, uses the BECS computer to assign frequencies to hopsets for HF and VHF radio networks. The computer mathematically manipulates the frequencies based on the restrictions the manager enters into the data base. The computer develops hopsets by correlating the restrictions with available frequencies.

b. Many subscriber duties and unit missions (for example, corps or division commanders and cavalry regiment) require travel through several different areas on the battlefield. Those same individuals or units require constant communications as they move across the battlefield. The BSM assigns a theater level hopset and TSK which provides mobile users effective communications and maintains legal frequency use.

(1) The common hopsets are determined from the frequencies available for use throughout the entire area of operation for the senior command. For example, the corps commander requires communications in the corps area and each of the division areas. The corps spectrum manager receives listings of

frequencies to be used in each area. The spectrum manager compares the lists and pulls out frequencies that are common to all areas under corps control. These frequencies are used to generate corps common hopsets.

(2) The hopsets for division must make maximum use of the available frequency resources. The division resource includes the corps common hopset and any special purpose hopset, which may rarely be required. The division spectrum manager determines the division hopsets and any special purpose hopset. The brigade does not have a spectrum manager; however, both brigade and battalion signal officers have an obligation to manage their network composition.

(3) The BSM assigns the maximum number of frequencies available in the area of operation and spreads the frequencies in the hopsets across the widest possible band to optimize ECCM capabilities. Spreading the frequencies across the spectrum is more important than increasing the total number of frequencies available. Fifty frequencies spread from 30 to 88 MHz is more effective than 200 frequencies from 30 to 35 MHz. Chances are slight that the jammer can cover the 58 MHz range or even a small portion of it with sufficient power to disrupt communications; however, a jammer could barrage jam the entire 5 MHz range.

c. HF networks require special considerations in frequency assignments. HF antenna tuning limits the range of frequencies allowed. The spectrum manager must consider the required circuit quality for the information to be passed. The farther the frequencies are dispersed from the center or tuning frequency, the poorer the quality of the circuit. This is especially true-for skywave transmissions since frequency affects the skip range. Even a small change in frequency can alter the path the signal takes through the atmosphere. (FM 24-18 and FM 11-64 cover radio wave propagation.) The spectrum manager must determine whether signal quality or antijam capability is most important when assigning frequency hopsets.

(1) High priority networks that pass critical information require high accuracy (whether voice or data). Such networks must use hopsets restricted to a narrow distribution of frequencies.

(2) Networks that are subject to high level jamming require maximum dispersion of frequencies in the hopset. The main drawback of wide dispersion of frequencies is poor system quality. The poor quality is due to lower radiated power from the antenna when the hops are on frequencies at the specified limits of the bands.

d. The NRI hopset scheme in Chapter 5 requires using only two hopsets throughout the corps area. The hopsets are specified by the corps spectrum manager, coordinated with the corps signal brigade, and included in the SOI data transferred from the corps to all divisional elements. The remaining hopping variables (TSK, net identifier, and time) are identical for all the NRI networks. This allows transient users access to the NRI system using a single preset position across the corps area.

e. Cue and manual frequencies for SINCGARS networks must be designated in the SOI for each time period. The cue frequency is assigned to a 50 kHz channel to allow older generation and allied radio users access to the network. The cue frequency must also be limited to the VHF band from 30 to 75.95 MHz. The manual frequency should be assigned to 25 kHz channels from 30 to 87.975 MHz. The BECS computer automatically assigns both frequencies along with a hopset using the above criteria. Table 7-1 shows the three items listed for each time period. The first is the hopset designation followed by the cue and manual frequencies. The radio operator must enter all three variables into the radio for each time period. If the operator wants to enter a network he is not normally in, the cue frequency is used.

Table 7-1. SOI extract for SINCGARS network.

UNIT	1	2	3	4	5
52D MECH DIV	F250	F378	F176	F234	F437
MAN	52.325	47.275	39.925	62.875	79.925
CUE	72.500	53.250	54.850	48.350	47.150
52D INTEL	F498	F265	F250	F378	F265
MAN	83.275	61.125	82.725	42.825	72.825
CUE	45.500	71.000	62.050	34.250	55.800

f. Planning must include provisions for interference between colocated radios of the same type (for example, single-channel to single-channel radios). The potential for interference exists in the single-channel nonhopping mode and the FH mode. Single-channel frequency assignments must comply with Table 5-1. The potential for interference increases as the total number of colocated FH networks increases. For example, a brigade CP may operate in up to six different FH networks at a time. The hopsets should maximize use of frequencies separate from any of the colocated networks. This can be planned, but it requires knowledge of network structures and which networks are colocated. The spectrum manager must work closely with the G3/S3 to minimize the effects on colocated networks.

g. Planning must consider possible interference between unlike radios (SINCGARS and MSRTs). SINCGARS can be programmed to lock out certain frequencies from the hopset. Neither BECS nor the system control center (SCC) can engineer frequency use for both systems at the same time. The spectrum manager must plan the MSRT/radio access unit (RAU) frequencies with the SCC and enter them into the BECS terminal as lockout sets. Frequency interference between the radio systems is minimized, particularly the cosited systems.

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h. The SCC provides frequency management to ensure no frequency conflicts exist between the RT-1539 (MSRT/RAU) and CNRs operating in the same area. This management applies only to VHF CNRs operating in the nonhopping mode. The SCC does not develop the hopping variables used by the SINCGARS. The VHF assignments are broken into protected channels and common (shared) channels. Protected frequencies are primarily assigned to radio nets which cover a large terrain area. This includes MSE MSRTs and division command nets.

i. Separate data network hopsets may be allocated to increase reliability of information when interference causes too many errors in data transmissions. This does not mean that the hopsets have sole use of all frequencies in the hopset.

j. Equipment constraints limit the total number of net identifiers to 1,000 (000 to 999). Numbers 000 through 099 are reserved for joint/theater units, 100 to 299 are for corps units, and the remainder (300 to 999) can be used by the divisions as the spectrum manager and division signal officer see fit. The net identifier assignments should be coordinated to simplify building the SOI data base.

(1) Net identifier numbers are assigned in the order they are entered into the BECS data base. Once assigned, net identifiers do not routinely change. Networks appear in current SOIs from higher echelon to lower. The type and number of networks vary little from one division to the next.

(2) The BECS data base manager develops reuse plans for the net identifier variable across the corps area. The simplest plan is to develop a single listing in the SOI for a type division and leave open net identifier assignments for variation between different division organizations. 'The divisional networks are numbered the same for type networks throughout the corps.

7-3. TSK Management

a. The current distribution scheme for TSK variables uses the same key for the entire corps. If operations require units to travel into another corps area, the corps in place q ust transfer the new TSK to the transient unit. The signal staff officer (SSO) or spectrum manager in the transient unit coordinates with the other corps SSO or spectrum manager to obtain the correct TSK.

(1) The TSK must be changed every 90 days. The TSK must be physically loaded into the radio from a fill device. The TSK variable may be transferred to the VINSON device over-the-air and then physically loaded into the radio from the VINSON. (See TM 11-5820-890-10-1 for additional information.) Users are prohibited from transmitting variables over nonsecure radio links.

(2) Fill devices should be loaded with the current and the succeeding TSK variables for quick transfer in case of compromise. The non-ICOM

SINCGARS radio can be filled with only the current and succeeding variables. The ICOM SINCGARS radio can hold up to six TSK variables.

(a) Maneuver units fill the positions with the TSK of the networks they are required to communicate with. In most cases, this is the corps common TSK for all six positions. Units located on the corps boundary load the TSK of the adjacent unit into position 5 with the adjacent unit hopset.

(b) Units that require communications with multiple echelons above corps (EAC) use the following assignments for the six presets:

- Position 1 - Local/division.
- Position 2 - Division/corps.
- Position 3 - Theater Army.
- Position 4 - Joint.
- Position 5 - Scratch location.
- Position 6 - TSK remote keying variable (RKV).

Positions 5 and 6 are used for remote keying of the TSKs over the radio link. The operators follow the same procedure used to remote key VINSON COMSEC variables. Ground units that require communications with tactical aircraft, such as air traffic control or forward air control units, use position 4 as the common TSK location.

b. The COMSEC TEK for VINSON and ICOM SINCGARS is the same as the X encryption keys used by the KY-68 DSVT and KY-90 NRI device. The keys are corps common and distributed by the corps COMSEC manager through the MSE system. KEK remains common only to the local network. The NCS capability to selectively remote key individuals is retained to protect the network should keyed equipment be captured. Remote key procedures for the new systems are the same as those used with the VINSON devices.

7-4. Time Management

a. Zulu or GMT is the time reference for all networks. This provides a standard time that allows the simplest access to any network. The network NCS or the net timing station (NTS) manages time.

b. SINCGARS can send the NCS time reference to the network subscriber over the radio link. This allows some leeway in time variation on initial loading. If the subscriber cannot enter the network, he has the NCS send the correct time data. Also, anytime the difference is between 4 seconds and 59 seconds, he must use LNE to access the net. Finally, SINCGARS can store a delta time difference between its clock time and that of other networks up to 59 minutes apart in the preset positions. By using GMT as the time reference, all networks will be well within that time limitation.

7-5. BSM Responsibilities

a. One of the BSM'S primary duties will be controlling and monitoring time for the commander. The corps and division BSMs establish authorized frequency assignments for their respective echelon and for subordinate units. The BSM is responsible for deconflicting frequency interference within his unit. He should be actively involved in the overall communications plan to ensure frequency plans and allocations meet the mission requirements at all levels within the command.

b. The frequency q anager starts the planning process by compiling the frequency requirements from the subordinate units. He combines the subordinate unit requirements with those of his echelon and forwards the request to the next higher headquarters. The combine and forward process continues upward to the unified command authority in the theater of operations. The J6 joint communications officer d`econflicts frequency use plans and allocates frequencies back down to component service BSMs.

c. The frequency allocations are divided at corps and division echelons. The BSM office assigns frequencies based on criteria similar to that used to develop the initial request. The most important criteria are--

- Network priority.
- Equipment in use.
- Equipment separation.
- Retransmission requirements.
- Frequency use restrictions.

d. The corps and division battlefield spectrum management offices develop SOI. The two offices work separately but in close coordination to produce the entire corps SOI.

(1) Previously, the NSA or the battlefield spectrum management office at corps and division produced SOIs. The frequency manager compiled all the SOI information, applied the above criteria, and sent the package to NSA for production. Once BECS is fielded, it will allow the manager to accomplish all the tasks at the home station and make changes to the end product easily and quickly. BECS increases the battlefield spectrum management office's efficiency in producing SOIs, distributing FH variables, and resolving interference problems.

(2) The corps battlefield spectrum management office produces and distributes the corps headquarters, corps units, and division command level SOI information. The corps frequency manager assigns restrictions to frequencies for hopset development. He determines the corps common hopsets, assigns hopsets to the corps units, and allocates frequencies to the divisions for use in their hopsets. The corps SOI information is transferred to the divisions for inclusion in their SOI data bases.

(3) The division battlefield spectrum management office incorporates the corps and division command level SOI information into its data base along with subordinate unit information. The division frequency manager assigns network restrictions and frequencies in BECS to develop the hopsets for division use. Once all information is in the data base, the division SOI is produced and distributed to the division and subordinate units.

e. The BSM is responsible for identifying the frequencies used by the MSRTs/RAUs in his area of operation. The corps battlefield spectrum management office under the G6 corps signal officer handles the coordination. The corps battlefield spectrum management office should have direct access to the SCC which assigns the MSRT/RAU frequency pairs (up to 96 pairs). The BSM compares the frequency pairs in use for a given time period and enters those into BECS as lockout sets for FH radios.

f. Interference resolution is handled at the lowest level possible. However, the battlefield spectrum management office has final jurisdiction in solving interference problems. The battlefield spectrum management office can solve interference on networks by--

- Requesting assistance from MI units in determining the source of the interference.
- Advising relocation of the affected network.
- Advising the user to work through the interference.
- Providing new frequency plans.

g. The battlefield spectrum management staff coordinates with all components operating in their area including airspace. Air Force, Navy, and Army aviation assets must be included in the planning to control all aspects of the AirLand Battle concept.

7-6. BSO Responsibilities

a. The signal officer assigned to combat brigade and battalion units has many duties and responsibilities. Those duties include all aspects of signal related topics that affect the maneuver unit's ability to fight and control the battle. FM 11-50 outlines the basic duties of the BSO, communications platoon leader, and communications chief. The responsibilities in FM 11-50 are still valid with the addition of the particular tasks associated with BECS and FH systems. This chapter addresses the specific tasks associated with the BECS computer, SOI tailoring, and distribution of the FH variables and SOI data.

b. The BSO's responsibility as a communications training developer and manager has increased importance with the fielding of new automated systems. FH radios present challenges in operator and planner training. The BECS computer gives the BSO an automated system for real-time SOI data and network management. As the primary BECS operator, the BSO--

- Develops and submits initial SOI data base information and subsequent revisions to higher headquarters.

- Determines network structures for the unit with the S3.

Coordinates with higher and adjacent headquarters for SOI and FH variables when the unit must operate outside normal channels.

- Develops distribution schemes for users in the unit networks.

- Develops operator training plans for EN remote fill procedures.

c. The EN can be filled with complete or partial SOI data from the corps or division down to platoon level. The BSO must coordinate with the unit S3 to determine which subscribers receive what portions of the SOI. This is called tailoring the SOI for specific user missions. By tailoring, the SOI units can develop electronically what was called the SOI extract. The BSO fills the subscriber EN with the required information to minimize the consequences should the EN be compromised.

d. BECS at the brigade and separate battalion level also gives the BSO a quick method of developing an SOI for task force organization. The BSO determines the units assigned to the task force from the mission operations order. Then, he uses the BECS terminal to pull out the call signs of those units and stores them in a separate file for recall.

e. The BSO is responsible for control and distribution of FH variables and SOI materials. BECS centralizes that control and simplifies distribution to the individual users in the unit. It allows the BSO to selectively fill subscriber ENs, locally and remotely, with the required SOI data. Since the BSO or a designated representative is the primary BECS operator, he has direct control over initial information loaded into each EN. The BSO also controls who the SOI is given to in the basic generation unit (BGU) to BGU transfers (such as brigade to battalion distribution). This provides the BSO centralized control of distribution and revision of SOI data in his unit.

f. The signal personnel authorized to battalion and brigade units has decreased with most equipment becoming user-owned and -operated. This places another burden on the BSO and communications chief to monitor communications procedures in their unit. Signal personnel will no longer

operate the majority of communications equipment. The primary users are the combat arms, CS, and CSS personnel throughout the battlefield. This increases the importance of a good training plan. The training plan ensures the general-purpose user (GPU) is familiar with operator procedures for all new pieces of equipment. Initial planning must include network activation and remote keying operations as well as remedial actions peculiar to FH radios.